PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements relating to Machines for the Production of Coated Tablets and the like

We, JOHN HOLROYD AND COMPANY LIMITED, a Company incorporated under the Laws of Great Britain, and FRANK THOMAS STOTT, a Subject of the Queen of Great Britain and Northern Ireland, both of the Company's address, Perseverence Works, Harbour Lane, Milnrow, near Rochdale in the County of Lancaster, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to machines for the production of coated tablets and the like and has for its main object to provide a novel construction by which it is made possible to obtain a uniform thickness of coat at every part of the coat.

The term "and the like" is intended to include any relatively small articles produced from comminuted powder by pressure and subsequently coated with the aid of pressure and therefore to include coated articles similar to coated tablets but known under other names such as coated pills, coated lozenges, coated charges and so forth.

According to the said invention, a machine for the production of coated tablets or the like comprises a rotary tablet core making mechanism for producing a core tablet, a rotary coating mechanism for coating the core tablet and having a coating die, and a rotary transfer mechanism for transferring a core tablet or the like fom the core tablet or the like making mechanism to the coating mechanism, the transfer mechanism being positively engaged with a part of the coating mechanism which, by its action on the transfer mechanism, causes the core tablet or the like to be moved in an arcuate path above and in alignment with the coating die for a period during which the core tablet or the like descends into the coating die and the transfer device withdraws from the core tablet or the like and the coating die.

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The transfer mechanism is also preferably positively engaged, during part of its rotation, by a part of the core tablet or the like producing mechanism which by its action on the transfer mechanism causes the transfer mechanism to be moved in an arcuate path above and in alignment with the core tablet or the like whilst it is being fed to the transfer mechanism.

The transfer mechanism preferably has a telescopic or contractile transfer arm free to yield resiliently from a predetermined basic position on a rotatable support and engagable by a part which is positively connected to the die to travel therewith.

The arm is preferably composed of a portion connected by a pivotal connection to a rotatable support and a second part which is slidable on the first part towards the pivotal connection against a spring load and carries a cavity to contain a core tablet and also has means whereby it can be engaged by a part which rotates with the die, a spring device being provided to retain it resiliently in a basic angular position relative to the rotatable support.

To transfer a core tablet or the like and place it in its proper position in the coating die, the transfer mechanism preferably has a parallel walled cavity in which the core tablet or the like can fit with a close sliding fit and which is provided in a tubular sleeve in which a weight is slidable, the sleeve and weight being raisable by any suitable means, such as a pin and cam, in order to release the core tablet or the like from their action on it after it has been settled by the cavity and weight in the die.

The weight is preferably adapted to be raised after the sleeve in order to use the weight to prevent the core tablet from being lifted out of its settled position by the sleeve and leave the weight free to press on the tablet during the settling period.

The sleeve may have a pin fixed to it for

operation by the cam and the said pin may engage an aperture in the weight which permits idle movement of the pin in it and thereby leaves the weight free to descend or delay its ascent independently of the sleeve.

The spring means for resiliently holding the arm in a predetermined angular position relative to the support is preferably a bar or rod spring one end of which is fixed to the support and the other end of which is slidable longitudinally in an aperture in the second part of the arm.

A stop pin is preferably provided on the first part of the arm to co-operate with a shoulder on a portion projecting from the second part of the arm in order to limit the degree to which the second part of the arm can move outwardly under spring load relative to the first part.

A bridge may be provided between the core tablet or the like making mechanism and the coating mechanism to form a platform along which the core tablet or the like can be slid in its transfer from the core tablet or the like making mechanism to the coating mechanism.

A bridge or the like may also be provided to retain the said sleeve and weight in a raised position during the return passage of the arm from the coating mechanism to the core tablet or the like making mechanism by forming a support therefor.

Alternatively the said cam may be extended sufficiently to keep the sleeve and weight in the raised position during the return of the arm from the coating mechanism to the core tablet or the like making mechanism.

The transfer mechanism is controlled by a part moving with the coating die so that the core tablet or the like holding portion of the tarnsfer mechanism runs into the circular path of the die and for a period follows the said circular path until the core tablet or the like has been placed and settled in the die whilst also being positively centralised relative to the die by the said part.

The invention also includes mechanism for enabling a sampling check on the core tablets produced by the tablet making mechanism without stopping the machine, such mechanism preferably including means for causing raising of a formed uncoated core tablet from a coating die in which it is being carried, and means for moving the core tablet from the coating die to a position where it can be collected, the mechanism being adapted to be brought into and out of operation when desired.

The said means for causing raising of a formed uncoated tablet from a coating die may consist of an auxiliary cam associated with a cam which controls the operation of a punch engaging the coating die and on which the core tablet is supported in the coating die, the auxiliary cam being movable into or out of operation as desired.

The said means for moving the core tablet may consist of one or more stationary deflectors adapted to move the core tablet after the latter has been raised and to move it outwardly over a rotating table containing the coating die to the collecting position.

The said deflector or deflectors may cause the core tablet to fall off the table on to a chute leading to a collector.

The said chute may be provided with two branches and means for alternatively opening one branch and closing the other, the said means being brought into operation on operation of the said auxiliary cam, whereby uncoated core tablets raised and deflected down the chute proceed down one branch thereof to a collector and coated core tablets proceed down the other branch to a separate collector.

The said chute branch for collecting uncoated core tablets may be closed and the other branch opened after a time delay following moving of the said auxiliary cam out of operation.

The said operations may be controlled from a single operating lever.

In order that the invention may be fully understood and more readily carried into practice we have caused to be appended hereunto drawings illustrating a constructional example thereof, wherein:—

Figures IA, IB constitute a side view, partly in section on a line corresponding with line I—I of Figures 2A, 2B of a machine for producing coated tablets.

Figures 2A, 2B constitute a plan view partly in section on a line corresponding with line 2—2 of Figure IA, IB.

Figure 3 is a fragmentary side view, partly in vertical section of a detail and showing parts in another position.

Figure 4 is a fragmentary end view of a detail and showing parts in still another position.

Figure 5 is an end elevation showing another detail.

Figures 3 and 4 are drawn to an enlarged scale.

Figure 6 is a fragmentary side elevation of a detail.

Figure 7 is an end view thereof.

Figure 8 is a fragmentary end view of a detail, and

Figure 9 is a plan view thereof

Referring to the drawings, which are more or less diagrammatical, there is a stationary base 1 on which a table 2 is rotatably mounted. The table 2 has dies 3 suitable for making core tablets of which two are shown and marked 4. Above the table there is a pillar 5 having a head 6 in which punches 7 are slidable for co-operation with punches 8 slidable in a foot 9 rotating with the table 2. The punches 8 operate in the dies 3 and there is a stationary cam 10 employed to raise

and lower the punches 7 which are also acted on by a roller (not shown) serving to force the punches 7 into the dies 3 at the appropriate time in order to compress powder fed by means of a stationary hopper 22 to the dies into core tablets. A stationary cam 11 acts on the punches 8 to raise them sufficiently to force the made core tablets out of the dies. One of the core tablets 4 is shown as just forced out of the die 3. So far the hereinbefore described mechanism is that already well known in the manufacture of tablets from powder by pressure.

The base 1 is also provided with a rotatable table 12 having a foot 13 provided with upwardly acting punches 14 and a pillar 15 provided with a head 16 having downwardly operating punches 17 controlled by a cam 18 for the major portion and acted on by a roller (not shown) for a period in order to compress what is inserted into coating dies 19 provided in the table 12. The head 16 rotates with the table 12. The tables 2 and 12 therefore their feet 9 and 13 and heads 6 and 16 are rotated at equal speeds in the direction of the arrows shown in Figure 2, for example with the aid of a worm wheel 20 connected to the table 2 through its foot 9 and a worm wheel 21 connected to the table 12 through its foot 13. The tables are arranged near each other.

Each punch 14 is controlled by a stationary cam 23 which operates to lower the punch a predetermined amount to enable the die 19 to receive a first charge of powder, then lower the punch to enable the die to receive a core tablet and finally to lower the punch still further to enable the die to receive a second charge of powder. A stationary hopper 24 is provided over the table 12 to supply the first charge to the die and another stationary hopper 25 is provided to supply the second charge to the die. A stationary cam 26 is combined with the two hoppers for a purpose which will be hereinafter described.

The ejected core tablet 4 is introduced into the die 19 between the supply of the first charge thereto and the supply of the second charge thereto, the die 19 being of greater diameter than the core tablet so that powder from the second charge can form a coat of the desired thickness round the edge of the tablet.

To introduce the core tablet ejected by the punch 8 into the die 19 there is the hereinafter described transfer mechanism:—

A bridge piece 27 and a bridge piece 28 are arranged stationarily between the tables 2 and 12 so as to form tracks which are continuations of the upper surfaces of the two tables. A spindle 29 is arranged between the tables and is rotated by a suitable driving mechanism synchronously with the tables 2 and 12. A plate 30 rotates with the spindle and has a plurality of arms 31 mounted on it by means of pivot pins 32 whereby each arm is free to swing on the plate independently of the other arms. Each arm 31 has a bracket 33 mounted slidably on it by means of a rod 34 slidably mounted in a longitudinal hole in the arm 31. The rod is urged outwards by a compression spring 35 in the said hole but the extent to which the bracket can be displaced outwards by the spring is limited by means of a stop 36 provided on the bracket and co-operating with an abutment pin 37 provided on the arm 31. The stop 36 also co-operates with the side of the arm 31 to limit rotation of the bracket 33 about the axis of the rod 34.

Although the arm 31 and therefore the bracket 33 are free to swing on the pivot 32, the swinging motion is controlled by a spring rod 39 fixed at 38 to the plate 30 and slidable in a hole 40 in the bracket 33, the said spring rod acting to yieldingly retain the arm and bracket in a normal position and to return the said arm and bracket to the normal position after being swung out of the same. The bracket has a fork 41 for engagement by a perforate boss 42 provided on the head 16 concentric with the axis of the respective punch 17 projecting therethrough. As the parts rotate, the fork of each bracket 33 moves into engagement with one of the bosses 42 and the movement of the bracket is thereafter controlled by the boss until the fork again moves out of engagement. The said bracket is therefore brought positively into phase with the punch 17 and constrained to follow the path of the punch 17 for a part of its revolution. Because the table 12 and head 16 are in fixed relationship to one another, the boss 42 is in fixed relationship to the die 19. Because the bracket 33 is brought into exact phase with the boss 42 it is also brought into exact phase with the die 19 for a sufficiently long period to enable a core tablet 4 to be deposited and settled in the die 19. For the purpose of depositing a core tablet, each bracket is provided with a sleeve 43 slidable up and down in the bracket 33 and having an external diameter at its lower end which enables it to form a sliding fit in the die 19, the internal diameter being such that the core tablet is a sliding fit therein. The sleeve has a pin 44 fixed to it and slidable up and down in a slot 45 in the bracket 33, the pin projecting beyond the bracket so that it can be acted on by the cam 26. In the sleeve there is a slidable weight 46 having a slot 47 which accommodates the pin 44 whilst allowing a predetermined amount of upward and downward movement of the weight independently of the pin and therefore of the sleeve 43.

The head 6 is also provided with perforate bosses 48 concentric with the punches 7 projecting therethrough and adapted by engagement with the forks 41 to positively make the

bracket 33 come into phase with the die 3 and move in phase with the said die and follow the path of said die for a period during the engagement of the fork with the collar. Each bracket 33 therefore follows the path indicated in Figure 2 by a dot-and-dash line 49 and it will be noticed that this path is changed from a circular path by the co-operation of the bosses 42 and 48 with the forks 41, the slidability of the rods 34 permitting this deviation. Furthermore because the arms can swing independently on their pivots 32 each arm can be moved out of its normal position by the boss engaged therewith if an irregularity in the spacing of the dies or some other similar irregularity demands a deviation of the bracket and arm from its normal state in order to enable the co-operation of the bosses with the forks to ensure exact registration and phasing of the sleeves with the dies for periods sufficiently long to enable the core tablets to be placed and settled centrally and on a level keel in the dies 19.

During the period that each bracket 33 moves in phase with a die 3, the respective punch 8 ejects a core tablet into the respective sleeve 43. The ejected tablet is slid along the table 2, the bridge 28 and the table 12 until it arrives above a die 19, by which time the corresponding boss 42 has taken charge of the bracket 33 and thereby ensured correct registration and phasing of the movements of the die 19 and the sleeve 43. The sleeve is kept in its raised position by sliding on the said surfaces and comes under the action of the cam 26, see Figures 1, 2 and 5, so that the pin rides on the surface of the cam, which surface has a fall 50, see Figure 5, which allows the pin and therefore the sleeve to sink during the period that it is moving in exact register and along the same path as the die. The sleeve therefore sinks with its lower end into the die at the same time that the tablet contained in the sleeve sinks into the die on to a previously inserted bed 52 of powder, aided by the weight 46 pressing by gravity on the tablet. The tablet is therefore controlled by the sleeve laterally until it has reached the bed 52 and is therefore positively located exactly centrally in the die whereby a uniform coating around its edge is ensured. Furthermore the weight pressing on the tablet counteracts any deviation of the tablet from an even keel, that is to say any deviation of the same from a horizontal position and thereby ensures that the bed 52 beneath the tablet shall be uniform and also that the covering above the tablet subsequently applied shall also be uniform. Whilst the boss 42 is still dictating the path of the bracket 33 a rise 51 of the cam 26 causes the pin 44 to rise and at the same time causes the sleeve 43 to rise until it is clear of the die 19. However, due to the slot 47, the weight 46 is not lifted out of the die until the sleeve has become disengaged from the tablet and the weight therefore operates to prevent the tablet from being lifted out of the die by the rising sleeve. However the pin after reaching the upper end of the slot 47 also lifts the weight clear of the die and the sleeve and weight are then in the position shown in Figure 3. After the pin 44 has left the cam 26, the sleeve and weight ride on the surface of the tables 2 and 12, and the bridge 27 as shown in Figure 4. As the newly formed core tablet is ejected by the respective punch 8 it pushes only the weight up into a higher position, which is permitted by the slot 47, and then only the sleeve and tablet slide on the tables 2 and 12 and the bridge 28.

The bed 52 of powder on to which the core tablet is fed is produced by powder falling from the hopper 24 into the die whilst the upper end of the punch is a distance below the orifice of the die and before the die meets the sleeve 43. After the die 19 has left the hopper 24, the punch 14 is lowered so that its upper end is a greater distance from the orifice of the die and there is therefore accommodation ready for the core tablet 4 before it is fed to die. After the tablet has been fed into the die and the sleeve and weight have been raised clear and have passed from the vicinity of the die, the punch 14 is lowered still further to cause its upper end to sink to a still greater distance below the die orifice so that the bed 52 and tablet 4 sink therein sufficiently to leave room for the covering powder, whereupon covering powder falls from the hopper 25 into the die to fill the uniform space left by the sleeve around the edge of the tablet and provide a uniform coating above the tablet. Thereafter the punch 17 is forced downwards with the requisite pressure in order to compress the bed and upper coating so as to form a complete coat around the core tablet.

The punch 17 is thereupon again raised into the position shown in Figure 1 clear of other parts and the punch 14 is thrust upwards to eject the coated tablet from the die, the coated tablet being thereupon guided to the edge of the table by a stationary guide strip 53 combined with the hopper 24. Figure 4 shows the sleeve, core tablet and weight when fully engaged with the die 19. To enable the sleeve to bed more readily on the bed 52 of powder already contained in the die, its lower edge may be provided with notches 54 as indicated in Figure 3.

Mechanism is also preferably provided for enabling a sampling check to be made when desired on the core tablets produced by the said tablet making mechanism without stopping the machine. One construction of mechanism shown more particularly in Figures 6, 7, 8 and 9 consists of an operating lever 55 having a handle 56 and pivoted at 57 to the stationary base 1 of the machine. The operating lever 55 has its non-handle end pivoted at 58 to one

arm of a bracket 59 which is mounted on the lower end of a rod 60 slidable in the stationary base 1. The upper end of the rod 60 is provided with a portion 61 which is slidable in a slot 62 in the groove of the cam 23, the portion 61 when projected from the slot 62 serving as an auxiliary cam. The rod 60 is furthermore provided with a collar 63 which can be adjusted in various positions along the rod as desired, the collar 63 being provided with two grooves 64, 65 respectively. Mounted on a part associated with the stationary base 1 is a member 66 having a spring loaded ball catch 67 adapted to engage with one or the other of the grooves 64, 65 in order to hold the rod 60 in either of two axial positions. An adjustable stop 68 is provided to limit the axial movement of the rod 60 in one direction.

The other arm of the bracket 59 is provided with an adjustable contact pin 69 adapted in one axial position of the rod 60 to engage with and close a spring loaded electric switch 70 and in the other axial position of the rod 60 to be disengaged from the switch 70 and thereby allow the switch 70 to open. The switch controls the supply of electric current to a solenoid 71 which when energised causes movement of a member 72 having one end of a chain 73 pivoted to it, the chain passing round a sprocket wheel 74 and its other end connected to a spring 75 anchored to a stationary part of the machine. The sprocket wheel 74 is fixed non-rotatably to a spindle 76 journalled in stationary bearings and coupled to a flexible shaft 77 which in turn is coupled to the pivot of a deflector plate 78. The deflector plate can occupy either of two angular positions, one in which it opens a chute 79 and closes another chute 80, and the other in which it closes the chute 79 and opens the chute 80.

In operation, when it is desired to obtain samples of the core tablets produced by the core tablet making mechanism without stopping the machine, the operating lever 55 is moved into the position in which it causes projection of the auxiliary cam formed by the portion 61 into the groove of the cam 23. This causes the next coating punch 14 which encounters the portion 61 to be lifted to an extent whereby its tip is flush with the surface of the table 12, whereby the core tablet 4 and bed of powder 52 contained in the die 19 are lifted above the surface of the table 12. Before the punch 17 moves downwardly a scraper blade 81 (see Figures 1B and 2B) deflects the core tablet 4 to the edge of the table 12 and scrapes the bed of powder 52 from the tip of the punch 14 but allows the powder to pass beneath the blade and travel with the table until it falls into and is collected by the hopper 24. The core tablet 4 travels with the table 12 near its outside edge and is deflected by the stationary guide strip 53 into the take-off chute having branches 79 and 80. Movement of the operating lever 55 has already moved the deflector plate 78 through the medium of switch 70, solenoid 71, chain 73, spindle 76 and flexible shaft 77, into the position in which branch chute 80 is open and branch chute 79 is closed. Core tablets for sampling therefore pass down chute 80 and can be collected.

When it is desired to discontinue sampling and revert to normal production of coated tablets, the operating lever is moved into its alternative position which removes the portion 61 from projection into the groove of the cam 23. Furthermore, the contact pin 69 is removed from contact with the switch 70. The switch 70 is provided with a time-delay device which prevents it from closing for a period during which core tablets already removed from their dies 19 are caused to pass down chute 80 for collection. On closure of the switch after the said delay, the solenoid 71 is deenergised and the spring 75 causes rotation of the sprocket wheel 74 and consequent movement of the deflector plate 78 so as to close the chute 80 and open the chute 79, down which the coated core tablets pass and can be collected separately from the uncoated core tablets which have passed down the chute 80.

What we claim is:—

1. A machine for the production of coated tablets or the like comprising a rotary tablet core making mechanism for producing a core tablet, a rotary coating mechanism for coating the core tablet and having a coating die, and a rotary transfer mechanism for transferring a core tablet or the like from the core tablet or the like making mechanism to the coating mechanism, the transfer mechanism being positively engaged with a part of the coating mechanism which, by its action on the transfer mechanism, causes the core tablet or the like to be moved in an arcuate path above and in alignment with the coating die for a period during which the core tablet or the like descends into the coating die and the transfer device withdraws from the core tablet or the like and the coating die.

2. A machine according to claim 1, wherein the transfer mechanism is also positively engaged, during part of its rotation, by a part of the core tablet or the like making mechanism which by its action on the transfer mechanism causes the transfer mechanism to be moved in an arcuate path above and in alignment with the core tablet or the like whilst it is being fed to the transfer mechanism.

3. A machine according to either of claims 1 and 2, wherein the transfer mechanism has a telescopic or contractile transfer arm free to yield resiliently from a predetermined basic position on a rotatable support and engagable by a part which is positively connected to the die to travel therewith.

4. A machine according to claim 3, wherein

the arm is composed of a part connected by a pivotal connection to a rotatable support and a second part which is slidable on the first part towards the pivotal connection against a spring load and carries a cavity to contain a core tablet and also has means whereby it can be engaged by a part which rotates with the die, a spring device being provided to retain it resiliently in a basic angular position relative to the rotatable support.

5. A machine according to any of the preceding claims, wherein, to transfer a core tablet or the like and place it in its proper position in the coating die, the transfer mechanism has a parallel walled cavity in which the core tablet or the like can fit with a close sliding fit and which is provided in a tubular sleeve in which a weight is slidable the sleeve and weight being raisable by any suitable means, such as a pin and cam, in order to release the core tablet or the like from their action on it after it has been settled by the cavity and weight in the die.

6. A machine according to claim 5, wherein the weight is adapted to be raised after the sleeve in order to use the weight to prevent the core tablet from being lifted out of its settled position by the sleeve and leave the weight free to press on the tablet during the settling period.

7. A machine according to either of claims 5 and 6, wherein the sleeve has a pin fixed to it for operation by a cam and the said pin engages an aperture in the weight which permits idle movement of the pin in it and thereby leaves the weight free to descend or delay its ascent independently of the sleeve.

8. A machine according to any of claims 4—7, wherein the spring means for resiliently holding the arm in a predetermined angular position relative to the support is a bar or rod spring one end of which is fixed to the support and the other end of which is slidable longitudinally in an aperture in the second part of the arm.

9. A machine according to any of claims 4—8, wherein a stop pin is provided on the first part of the arm to co-operate with a shoulder on a portion projecting from the second part of the arm in order to limit the degree to which the second part of the arm can move outwardly under spring load relative to the first part.

10. A machine according to any of the preceding claims, wherein a bridge is provided between the core tablet or the like making mechanism and the coating mechanism to form a platform along which the core tablet or the like can be slid in its transfer from the core tablet or the like making mechanism to the coating mechanism.

11. A machine according to any of claims 5—10, wherein a bridge or the like is provided to retain the said sleeve and weight in a raised position during the return passage of the arm from the coating mechanism to the core tablet or the like making mechanism by forming a support therefor.

12. A machine according to any of claims 5—11, wherein the said cam is extended sufficiently to keep the sleeve and weight in the raised position during the return of the arm from the coating mechanism to the core tablet or the like making mechanism.

13. A machine according to any of the preceding claims, wherein the transfer mechanism is controlled by a part moving with the coating die so that the core tablet or the like holding portion of the transfer mechanism runs into the circular path of the die and for a period follows the said circular path until the core tablet or the like has been placed and settled in the die whilst also being positive centralised relative to the die by the said part.

14. A machine according to any of the preceding claims, including mechanism for enabling a sampling check on the core tablets or the like produced by the core tablet or the like making mechanism without stopping the machine, such mechanism including means for causing raising of a formed uncoated core tablet or the like from a coating die in which it is being carried, and means for moving the core tablet or the like from the coating die to a position where it can be collected, the mechanism being adapted to be brought into and out of operation as desired.

15. A machine according to claim 14, wherein the said means for causing raising of a formed uncoated core tablet or the like from a coating die consists of an auxiliary cam which controls the operation of a punch engaging the coating die and on which the core tablet or the like is supported in the coating die, the auxiliary cam being movable into or out of operation as desired.

16. A machine according to either of claims 14 and 15, wherein the said means for moving the core tablet consists of one or more stationary deflectors adapted to move the core tablet or the like after the latter has been raised and to move it outwardly over a rotatable table containing the coating die to a collecting position.

17. A machine according to claim 16, wherein the said deflector or deflectors cause the core tablet or the like to fall off the table on to a chute leading to a collector.

18. A machine according to claim 17, wherein the said chute is provided with two branches and means for alternatively opening one branch and closing the other, the said means being brought into operation on operation of the said auxiliary cam, whereby uncoated core tablets or the like raised and deflected down the chute proceed down one branch thereof to a collector and coated core tablets or the like proceed down the other branch to a separate collector.

19. A machine according to claim 18, wherein the said chute branch for collecting uncoated core tablets is closed and the other branch opened after a time delay following moving of the said auxiliary cam out of operation.

20. A machine according to any of claims 14—19, wherein the said operations are controlled from a single operating lever.

21. For the production of coated tablets or the like, a machine substantially as hereinbefore described with reference to the accompanying drawings.

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PROVISIONAL SPECIFICATION

Improvements relating to Machines for the Production of Coated Tablets and the like

We, JOHN HOLROYD AND COMPANY LIMITED, a Company incorporated under the Laws of Great Britain, and FRANK THOMAS STOTT, a Subject of the Queen of Great Britain and Northern Ireland, both of the Company's address, Perseverence Works, Harbour Lane, Milnrow, near Rochdale in the County of Lancaster do hereby declare this invention to be described in the following statement:—

This invention relates to machines for the production of coated tablets and the like and has for its main object to provide a novel construction by which it is made possible to obtain a uniform thickness of coat at every part of the coat.

The term "and the like" is intended to include any relatively small articles produced from comminuted powder by pressure and subsequently coated with the aid of pressure and therefore to include coated articles similar to coated tablets but known under other names such as coated pills, coated lozenges, coated charges and so forth.

According to the said invention, a machine for the production of coated tablets or the like comprises a tablet making mechanism for producing a core tablet, a coating mechanism for coating the core tablet and having a coating die, and a transfer mechanism for transferring a core tablet or the like from the core tablet or the like making mechanism to the coating mechanism the transfer mechanism being positively engaged with and controlled during a restricted period by a part of the coating mechanism which by its action on the transfer mechanism brings and keeps the core tablet or the like truly in phase with the coating die for a period during which the core tablet or the like descends under control into the coating die and the transfer device withdraws from the core tablet or the like and the coating die.

The transfer mechanism is also preferably positively engaged with and controlled during another restricted period by a part of the core tablet of the like producing mechanism which by its action on the transfer mechanism brings and keeps the transfer mechanism truly in phase with the core tablet or the like whilst being fed to the transfer mechanism.

The transfer mechanism preferably has a telescopic or contractile transfer arm free to yield resiliently from a predetermined basic position on a rotatable support and engagable by a part which is positively connected to the die to travel therewith.

The arm is preferably composed of a portion connected by a pivotal connection to a rotatable support and a second part which is slidable on the first part towards the pivotal connection against a spring load and carries a cavity to contain a core tablet and also has means whereby it can be engaged by a part which rotates with the die, a spring device being provided to retain it resiliently in a basic angular position relative to the rotatable support.

To transfer a core tablet or the like and place it in its proper position in the coating die it preferably has a parallel walled cavity in which the core tablet or the like can fit with a close sliding fit and which is provided on a tubular slide in which a weight is slidable, the sleeve and weight being raisable by any suitable means, such as a pin and cam, in order to release the core tablet or the like from their action on it after it has been settled by the cavity and weight in the die.

The weight is preferably adapted to be raised after the sleeve in order to use the weight to prevent the core tablet from being lifted out of its settled position by the sleeve and leave the weight free to press on the tablet during the settling period.

The sleeve may have a pin fixed to it for operation by the cam and the said pin may engage an aperture in the weight which permits idle movement of the pin in it and thereby leaves the weight free to descend or delay its ascent independently of the sleeve.

The spring means for resiliently holding the arm in a predetermined angular position relative to the support is preferably a bar or rod spring one end of which is fixed to the

support and the other end of which is slidable longitudinally in an aperture in the second part of the arm.

A stop pin is preferably provided on the first part of the arm to co-operate with a shoulder on a portion projecting from the second part of the arm in order to limit the degree to which the second part of the arm can move outwardly under spring load relative to the first part.

A bridge is provided between the core tablet or the like making mechanism and the coating mechanism to form a platform along which the core tablet or the like can be slid in its transfer from the core tablet or the like making mechanism and the coating mechanism.

A bridge or the like may also be provided to retain the said sleeve and weight in a raised position during the return passage of the arm from the coating mechanism to the core tablet or the like making mechanism by forming a support therefor.

Alternatively the said cam may be extended sufficiently to keep the sleeve and weight in the raised position during the return of the arm from the coating mechanism to the core tablet or the like making mechanism.

The transfer mechanism is controlled by a part moving with the coating die so that the core tablet or the like holding portion of the transfer mechanism runs into the circular path of the die and for a period follows the said circular path until the core tablet or the like has been placed and settled in the die whilst also being positively centralised relative to the die by the said part.

In the accompanying drawings, which illustrate a constructional example:—

Figure 1 is a side view, partly in section on a line corresponding with line 1—1 of Figure 2 of a machine for producing coated tablets.

Figure 2 is a plan view partly in section on a line corresponding with line 2—2 of Figure 1.

Figure 3 is a fragmentary side view, partly in vertical section of a detail and showing parts in another position.

Figure 4 is a fragmentary end view of a detail and showing parts in still another position.

Figure 5 is an end elevation showing another detail.

Figures 3 and 4 are drawn to an enlarged scale.

Referring to the drawings, which are more or less diagrammatical, there is a stationary base 1 on which a table 2 is rotatably mounted. The table 2 has dies 3 suitable for making core tablets of which two are shown and marked 4. Above the table there is a pillar 5 having a head 6 in which punches 7 are slidable for co-operation with punches 8 slidable in a foot 9 rotating with the table 2. The punches 8 operate in the dies 3 and there is a stationary cam 10 employed to raise and lower the punches 7 which are also acted on by a roller (not shown) serving to force the punches 7 into the dies 3 at the appropriate time in order to compress powder fed by means of a stationary hopper 22 to the dies into core tablets. A stationary cam 11 acts on the punches 8 to raise them sufficiently to force the made core tablets out of the dies. One of the core tablets 4 is shown as just forced out of the die 3. So far the hereinbefore described mechanism is that already well-known in the manufacture of tablets from powder by pressure.

The base 1 is also provided with a rotatable table 12 having a foot 13 provided with upwardly acting punches 14 and a pillar 15 provided with a head 16 having downwardly operating punches 17 controlled by a cam 18 for the major portion and acted on by a roller (not shown) for a period in order to compress what is inserted into coating dies 19 provided in the table 12. The head 16 rotates with the table 12. The tables 2 and 12 and therefore their feet 9 and 13 and heads 6 and 16 are rotated at equal speeds in the direction of the arrows shown in Figure 2, for example with the aid of a worm wheel 20 connected to the table 2 through its foot 9 and a worm wheel 21 connected to the table 12 through its foot 13. The tables are arranged near each other.

Each punch 14 is controlled by a stationary cam 23 which operates to lower the punch a predetermined amount to enable the die 19 to receive a first charge of powder, then lower the punch to enable the die to receive a core tablet and finally to lower the punch still further to enable the die to receive a second charge of powder. A stationary hopper 24 is provided over the table 12 to supply the first charge to the die and another stationary hopper 25 is provided to supply the second charge to the die. A stationary cam 26 is combined with the two hoppers for a purpose which will be hereinafter described.

The ejected core tablet 4 is introduced into the die 19 between the supply of the first charge thereto and the supply of the second charge thereto, the die 19 being of greater diameter than the core tablet so that powder from the second charge can form a coat of the desired thickness round the edge of the tablet.

To introduce the core tablet ejected by the punch 8 into the die 19 there is the hereinafter described transfer mechanism:—

A bridge piece 27 and a bridge piece 28 are arranged stationarily between the tables 2 and 12 so as to form tracks which are continuations of the upper surfaces of the two tables. A spindle 29 is arranged between the tables and is rotated by a suitable driving mechanism synchronously with the tables 2 and 12. A plate 30 rotates with the spindle and has a plurality of arms 31 mounted on it by means of pivot pins 32 whereby each arm is free to

swing on the plate independently of the other arms. Each arm 31 has a bracket 33 mounted slidably on it by means of a rod 34 slidably mounted in a longitudinal hole in the arm 31. The rod is urged outwards by a compression spring 35 in the said hole but the extent to which the bracket can be displaced outwards by the spring is limited by means of a stop 36 provided on the bracket and co-operating with an abutment pin 37 provided on the arm 31. The stop 36 also co-operates with the side of the arm 31 to limit rotation of the bracket 33 about the axis of the rod 34.

Although the arm 31 and therefore the bracket 33 are free to swing on the pivot 32, the swinging motion is controlled by a spring rod 38 fixed at 39 to the plate 30 and slidable in a hole 40 in the bracket 33, the said spring rod acting to yieldingly retain the arm and bracket in a normal position and to return the said arm and bracket to the normal position after being swung out of the same. The bracket has a fork 41 for engagement by a perforate boss 42 provided on the head 16 concentric with the axis of the respective punch 17 projecting therethrough. As the parts rotate, the fork of each bracket 33 moves into engagement with one of the bosses 42 and the movement of the bracket is thereafter controlled by the boss until the fork again moves out of engagement. The said bracket is therefore brought positively into phase with the punch 17 and constrained to follow the path of the punch 17 for a part of its revolution. Because the table 12 and head 16 are in fixed relationship to one another, the boss 42 is in fixed relationship to the die 19. Because the bracket 33 is brought into exact phase with the boss 42 it is also brought into exact phase with the die 19 for a sufficiently long period to enable a core tablet 4 to be deposited and settled in the die 19. For the purpose of depositing a core tablet, each bracket is provided with a sleeve 43 slidable up and down in the bracket 33 and having an external diameter at its lower end which enables it to form a sliding fit in the die 19, the internal diameter being such that the core tablet is a sliding fit therein. The sleeve has a pin 44 fixed to it and slidable up and down in a slot 45 in the bracket 33, the pin projecting beyond the bracket so that it can be acted on by the cam 26. In the sleeve there is a slidable weight 46 having a slot 47 which accommodates the pin 44 whilst allowing a predetermined amount of upward and downward movement of the weight independently of the pin and therefore of the sleeve 43.

The head 6 is also provided with perforate bosses 48 concentric with the punches 7 projecting therethrough and adapted by engagement with the forks 41 to positively make the bracket 33 come into phase with the die 3 and move in phase with the said die and follow the path of the said die for a period during the engagement of the fork with the collar. Each bracket 33 therefore follows the path indicated in Figure 2 by a dot-and-dash line 49 and it will be noticed that this path is changed from a circular path by the co-operation of the bosses 42 and 48 with the forks 41, the slidability of the rods 34 permitting this deviation. Furthermore because the arms can swing independently on their pivots 32 each arm can be moved out of its normal position by the boss engaged therewith if an irregularity in the spacing of the dies or some other similar irregularity demands a deviation of the bracket and arm from its normal state in order to enable the co-operation of the bosses with the forks to ensure exact registration and phasing of the sleeves with the dies for periods sufficiently long to enable the core tablets to be placed and settled centrally and on a level keel in the dies 19.

During the period that each bracket 33 moves in phase with a die 3, the respective punch 8 ejects a core tablet into the respective sleeve 43. The ejected tablet is slid along the table 2, the bridge 28 and the table 12 until it arrives above a die 19, by which time the corresponding boss 42 has taken charge of the bracket 33 and thereby ensured correct registration and phasing of the movements of the die 19 and the sleeve 43. The sleeve is kept in its raised position by sliding on the said surfaces and comes under the action of the cam 26 so that the pin rides on the surface of the cam, which surface has a fall 50 which allows the pin and therefore the sleeve to sink during the period that it is moving in exact register and along the same path as the die. The sleeve therefore sinks with its lower end into the die at the same time that the tablet contained in the sleeve sinks into the die on to a previously inserted bed 52 of powder, aided by the weight 46 pressing by gravity on the tablet. The tablet is therefore controlled by the sleeve laterally until it has reached the bed 52 and is therefore positively located exactly centrally in the die whereby a uniform coating around its edge is ensured. Furthermore the weight pressing on the tablet counteracts any deviation of the tablet from an even keel, that is too say any deviation of the same from a horizontal position and thereby ensures that the bed 52 beneath the tablet shall be uniform and also that the covering above the tablet subsequently applied shall also be uniform. Whilst the boss 41 is still dictating the path of the bracket 33 a rise 51 of the cam 26 causes the pin 44 to rise and at the same time causes the sleeve 43 to rise until it is clear of the die 19. However, due to the slot 47, the weight 46 is not lifted out of the die until the sleeve has become disengaged from the tablet and the weight therefore operates to prevent the tablet from being lifted out of the die by the rising

sleeve. However the pin after reaching the upper end of the slot 47 also lifts the weight clear of the die and the sleeve and weight are then in the position shown in Figure 3. After the pin 44 has left the cam 26, the sleeve and weight ride on the surface of the tables 2 and 12, and the bridge 27 as shown in Figure 4. As the newly formed core tablet is ejected by the respective punch 8 it pushes only the weight up into a higher position, which is permitted by the slot 47, and then only the sleeve and tablet slide on the tables 2 and 12 and the bridge 28.

The bed 52 of powder on to which the core tablet is fed is produced by powder falling from the hopper 24 into the die whilst the upper end of the punch is a distance below the orifice of the die and before the die meets the sleeve 43. After the die 19 has left the hopper 24, the punch 14 is lowered so that its upper end is a greater distance from the orifice of the die and there is therefore accommodation ready for the core tablet 4 before it is fed to the die. After the tablet has been fed into the die and the sleeve and weight have been raised clear and have passed from the vicinity of the die, the punch 14 is lowered still further to cause its upper end to sink to a still greater distance below the die orifice so that the bed 52 and tablet 4 sink therein sufficiently to leave room for the covering powder, whereupon covering powder falls from the hopper 25 into the die to fill the uniform space left by the sleeve around the edge of the tablet and provide a uniform coating above the tablet. Thereafter the punch 17 is forced downwards with the requisite pressure in order to compress the bed and upper coating so as to form a complete coat around the core tablet.

The punch 17 is thereupon again raised into the position shown in Figure 1 clear of other parts and the punch 14 is thrust upwards to eject the coated tablet from the die, the coated tablet being thereupon guided to the edge of the table by a stationary guide strip 52 combined with the hopper 24. Figure 4 shows the sleeve, core tablet and weight when fully engaged with the die 19. To enable the sleeve to bed more readily on the bed 53 of powder already contained in the die, its lower edge may be provided with notches 54 as indicated in Figure 3.

For the Applicants,
F. BOSSHARDT,
Chartered Patent Agent.

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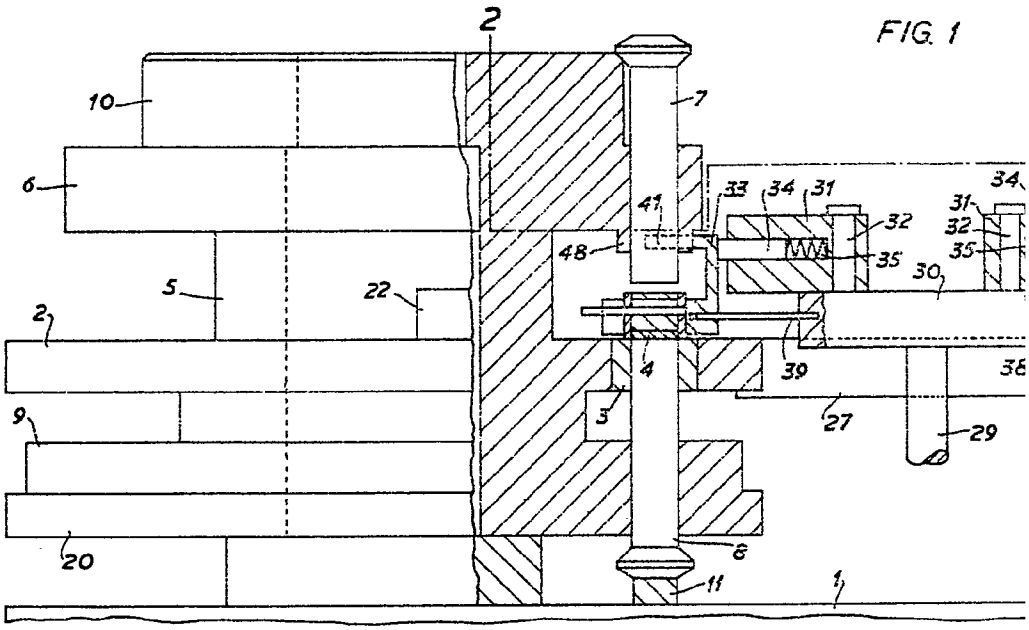
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

FIG. 1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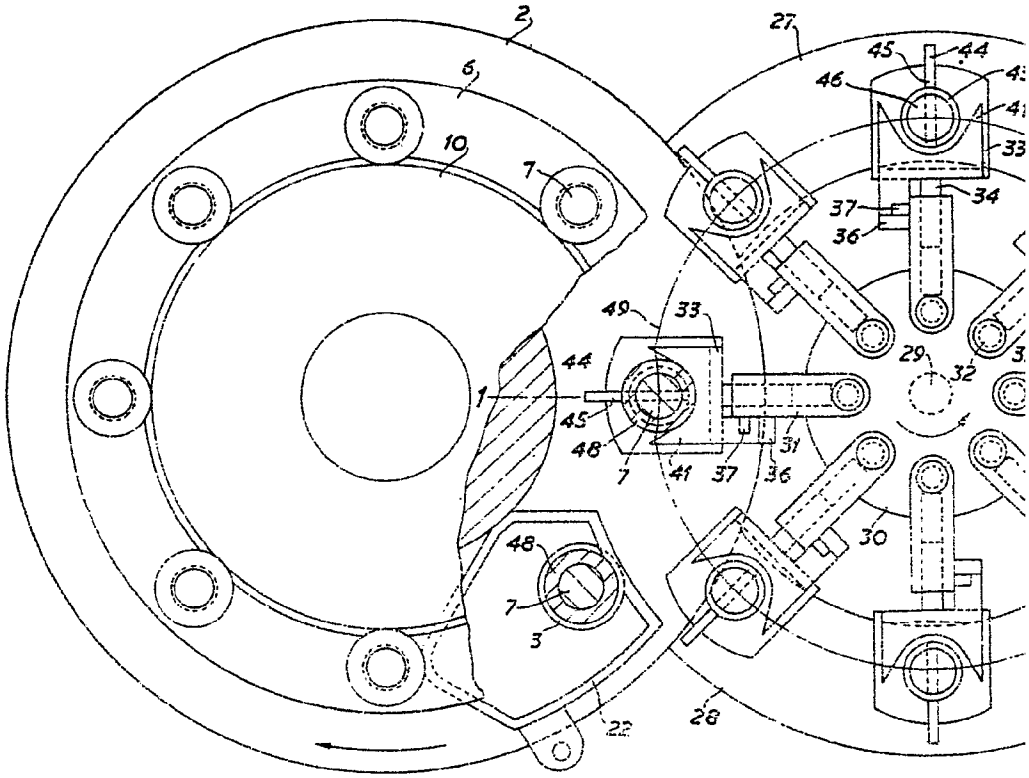
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759,081 PROVISIONAL SPECIFICATION

2 SHEETS

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SHEET 1

FIG. 1

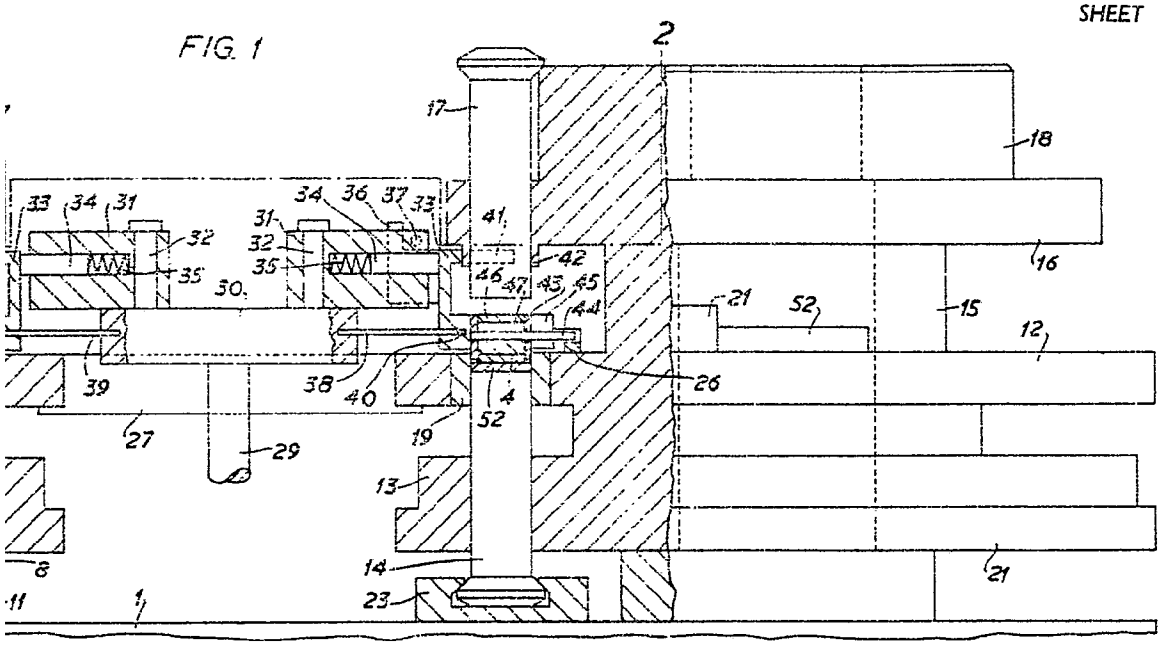
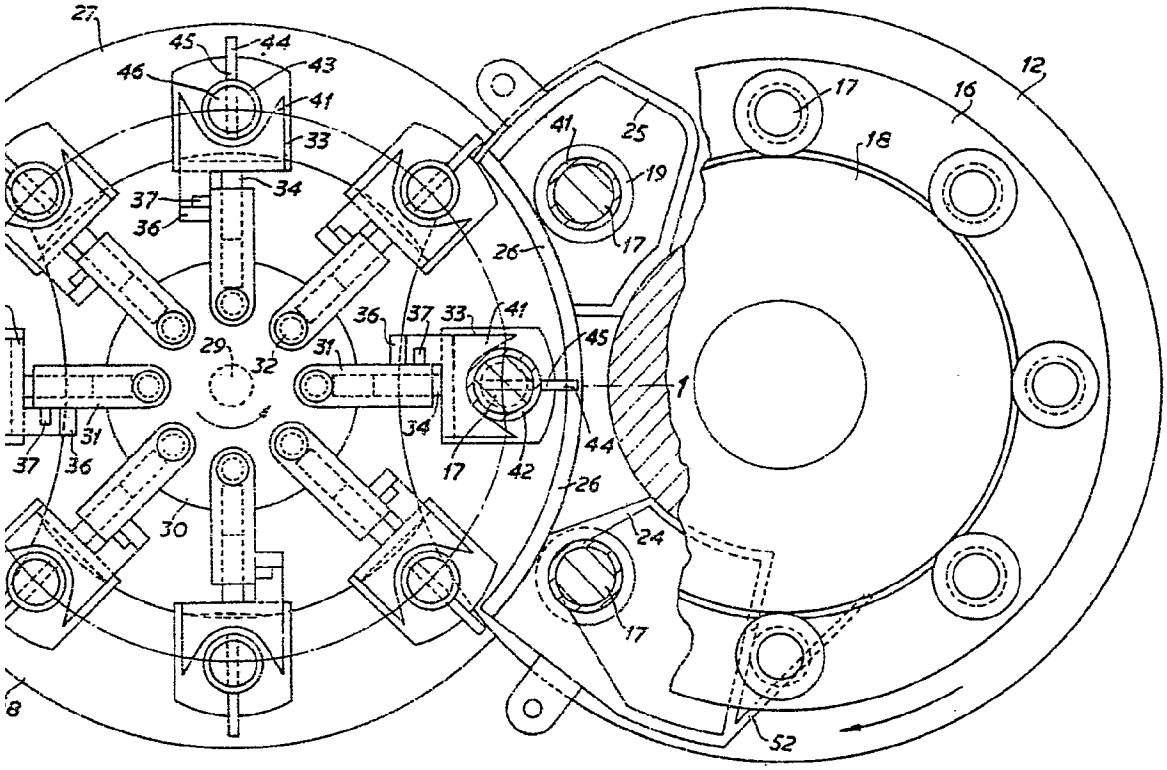


FIG. 2



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SHEET 1

FIG. 1

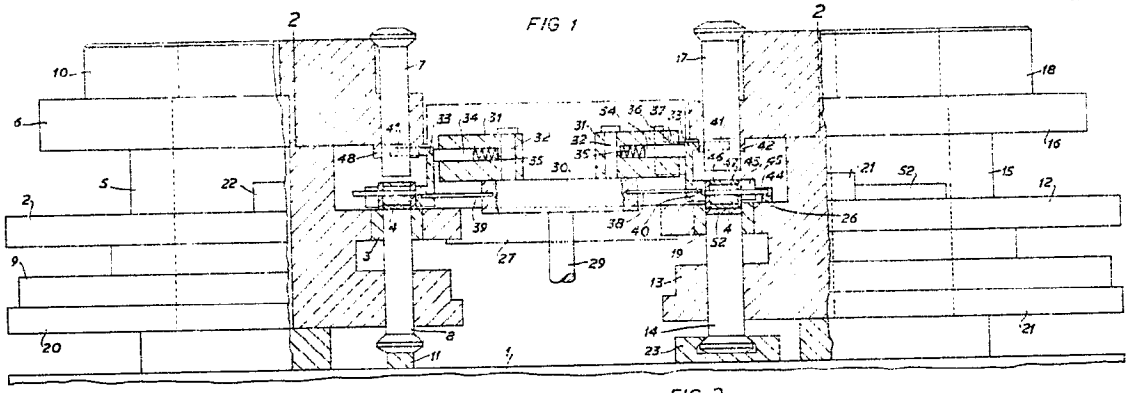


FIG. 2

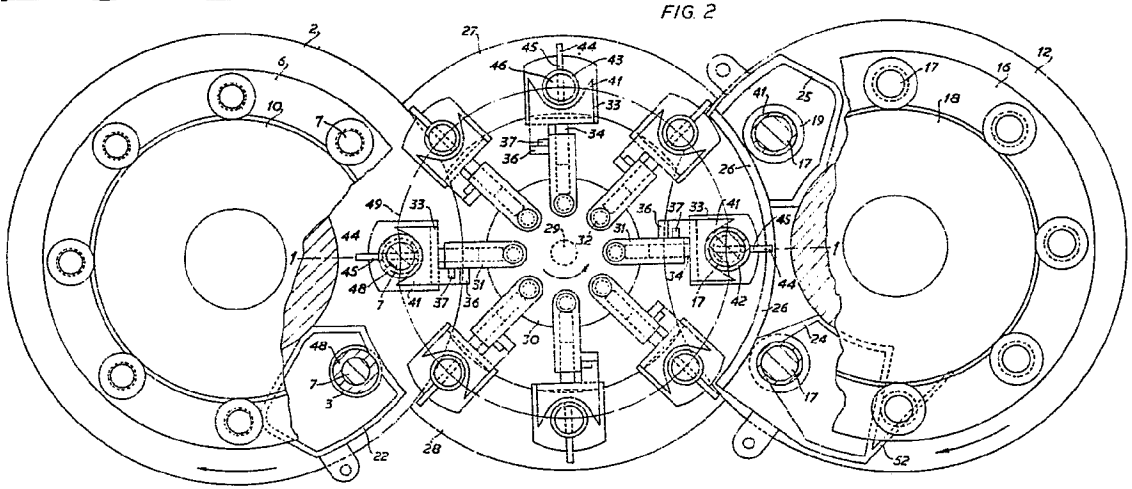


FIG. 3

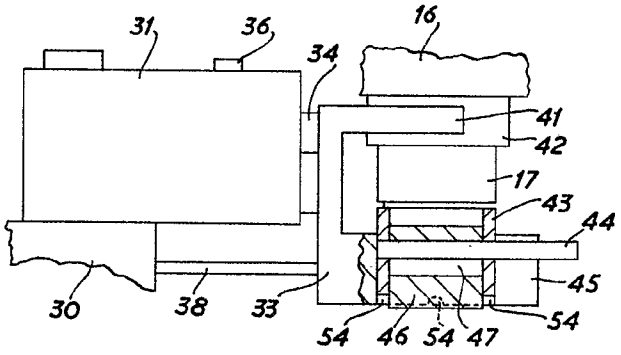


FIG. 4

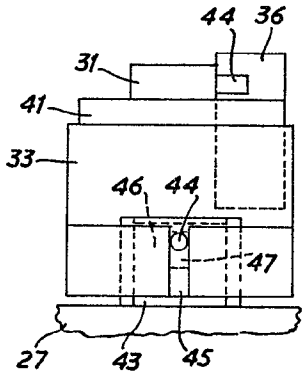


FIG. 5

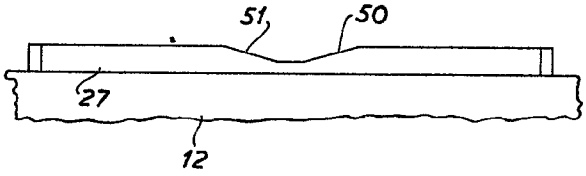


FIG. 1A.

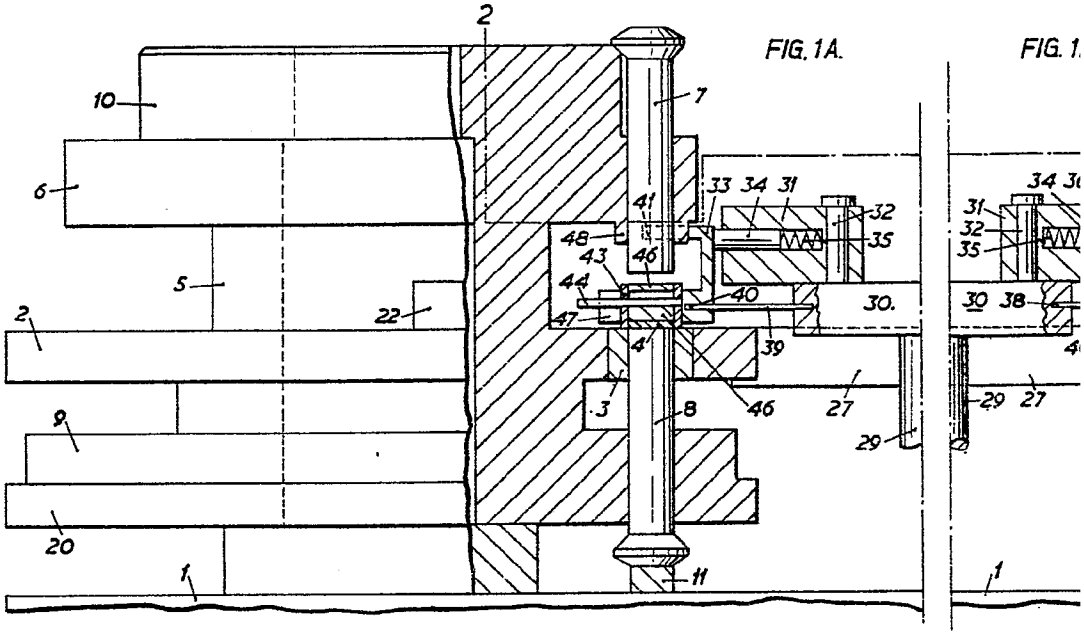


FIG. 3

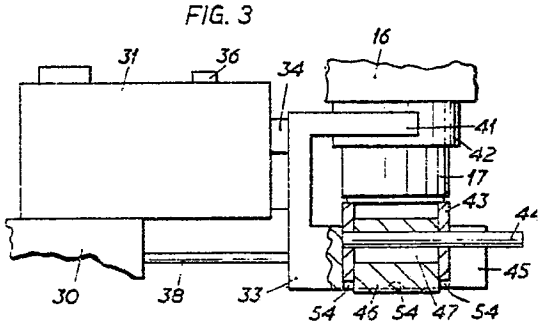
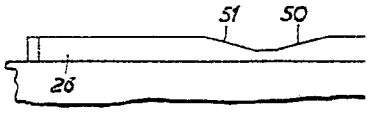


FIG. 5



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4 SHEETS

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SHEET 1

1A.

FIG. 1B

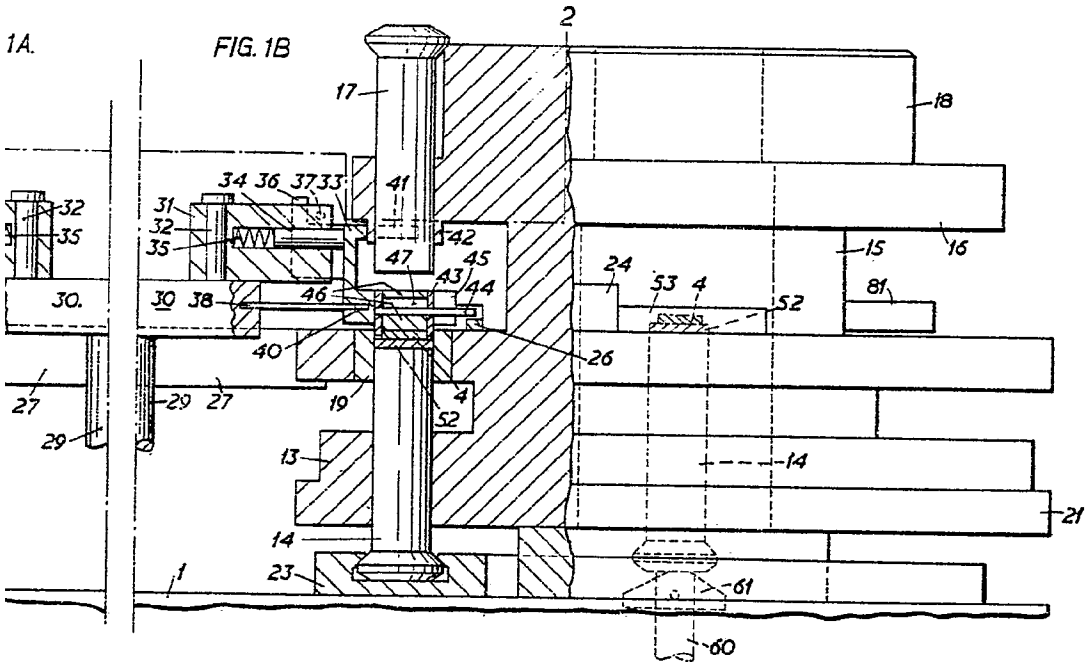

FIG. 4

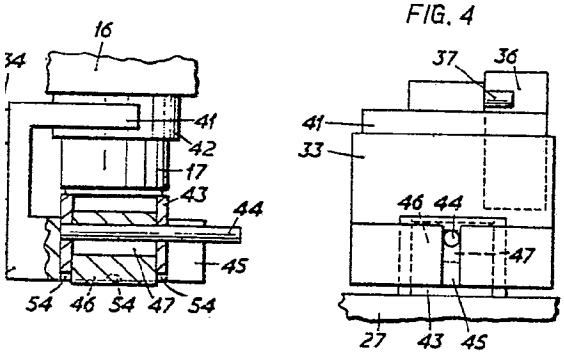

FIG. 5

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SHEET 1

FIG. 1A

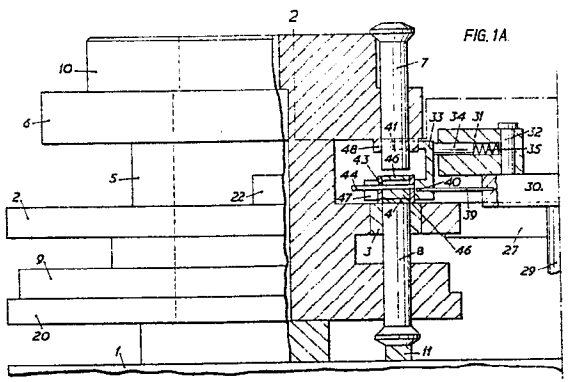

FIG. 1B

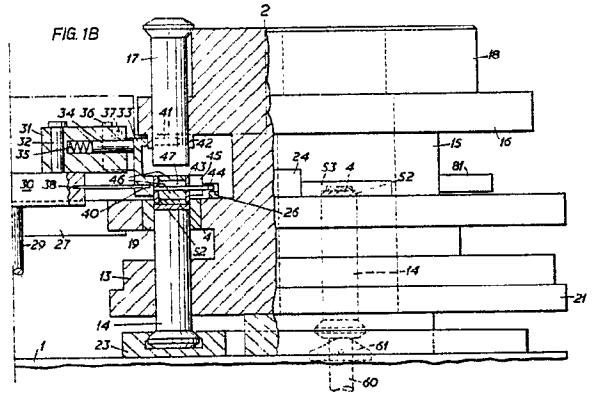

FIG. 3

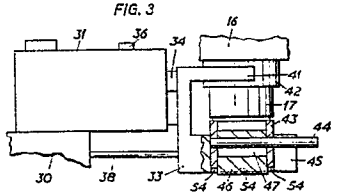

FIG. 4

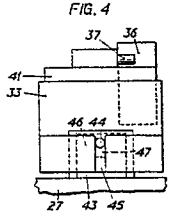

FIG. 5

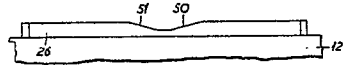

FIG. 2A

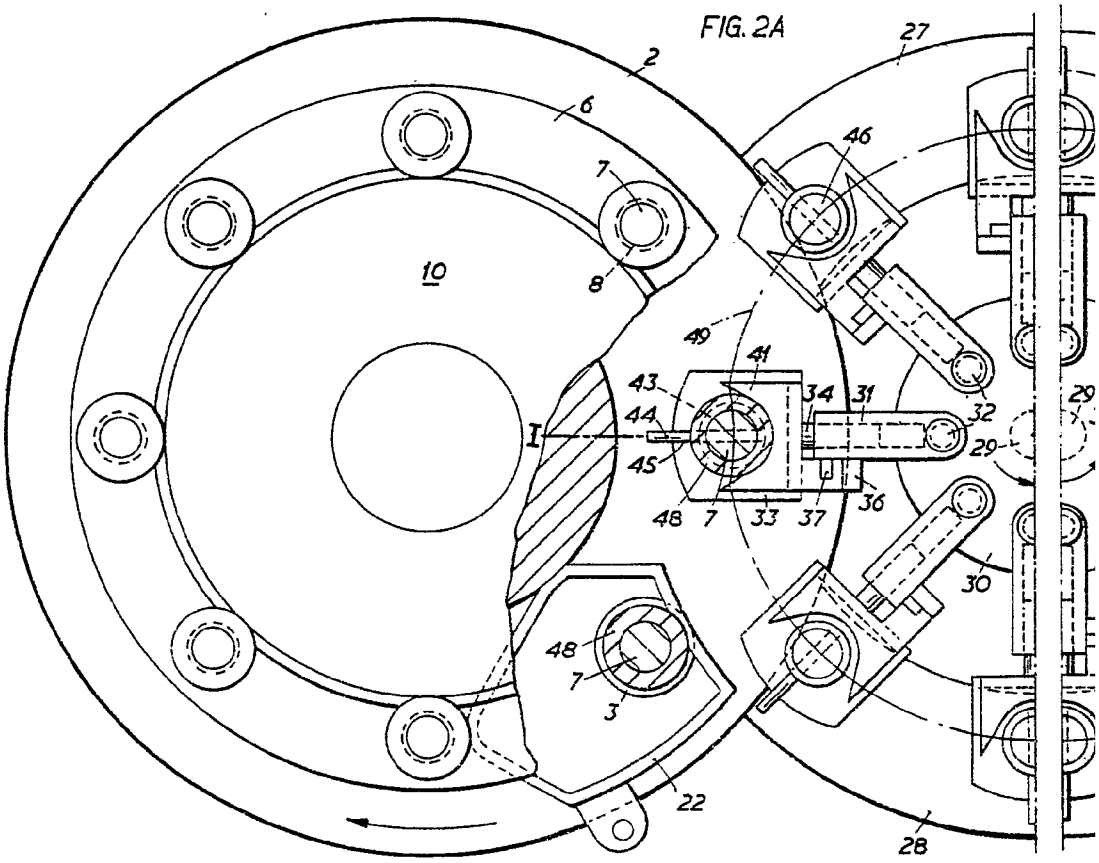

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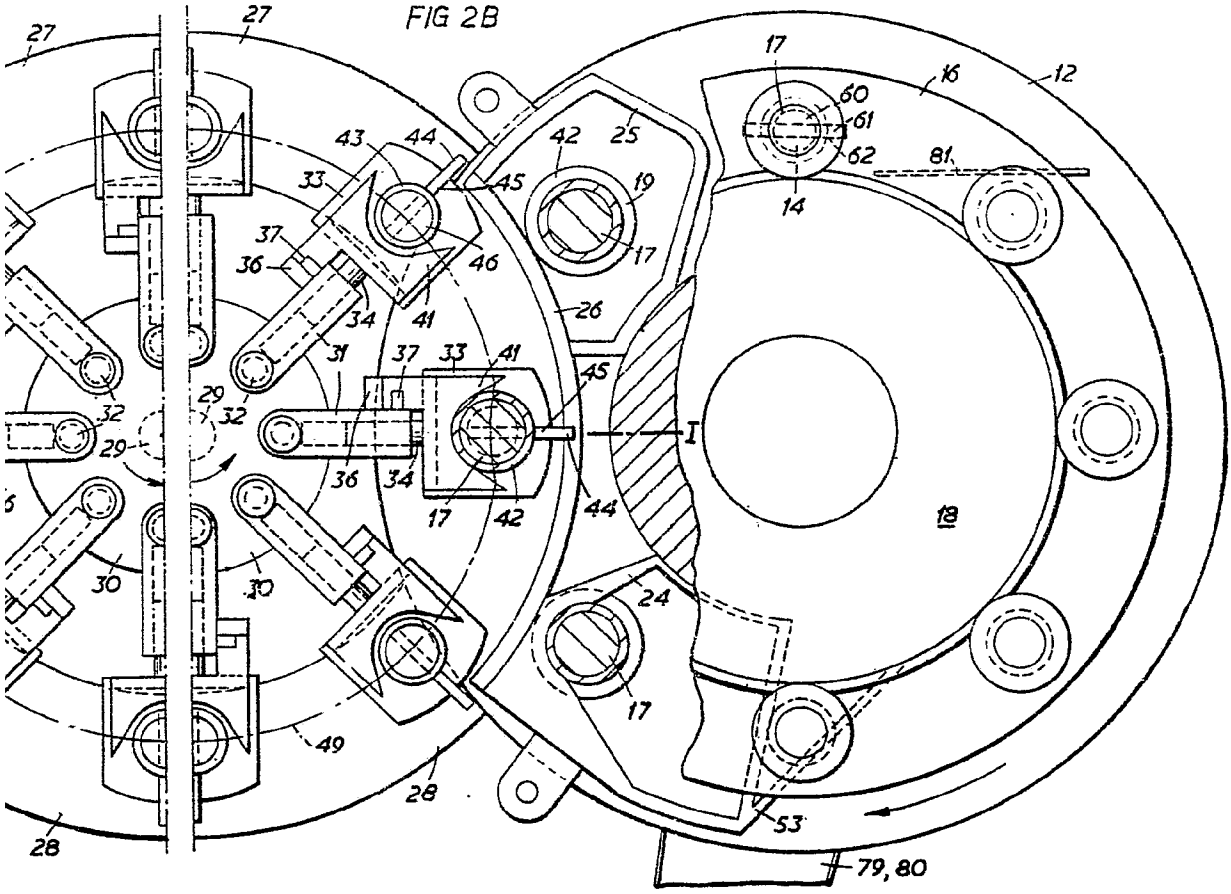
FIG 2B



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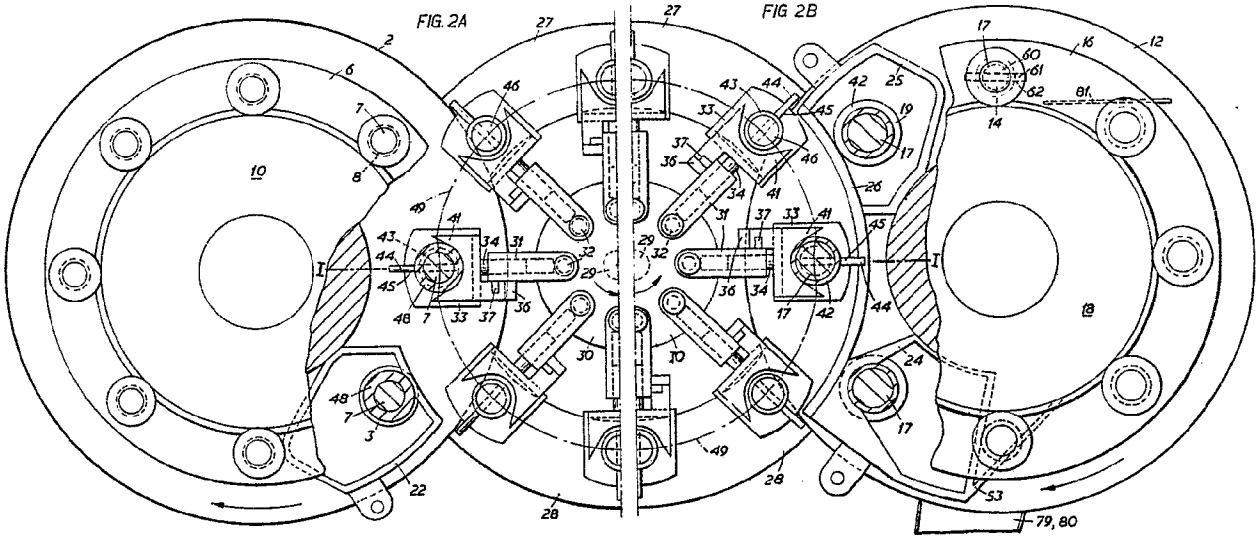

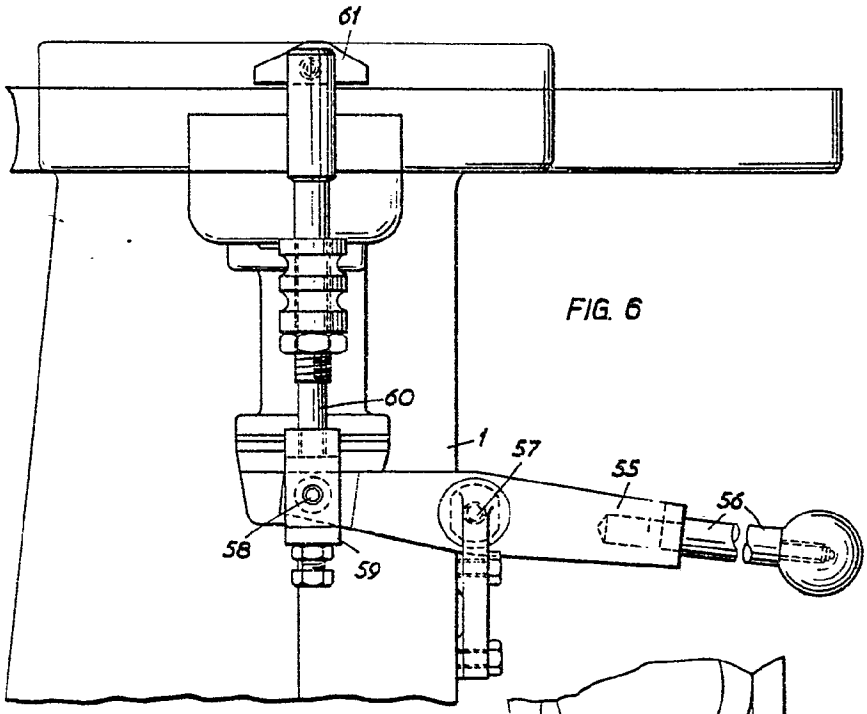

FIG. 6

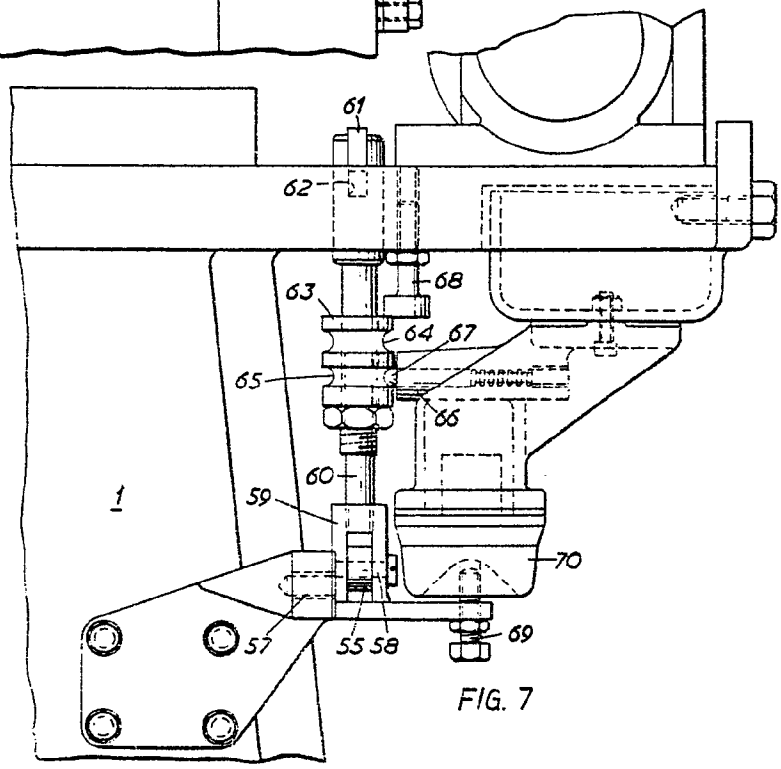

FIG. 7

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SHEETS 3 & 4

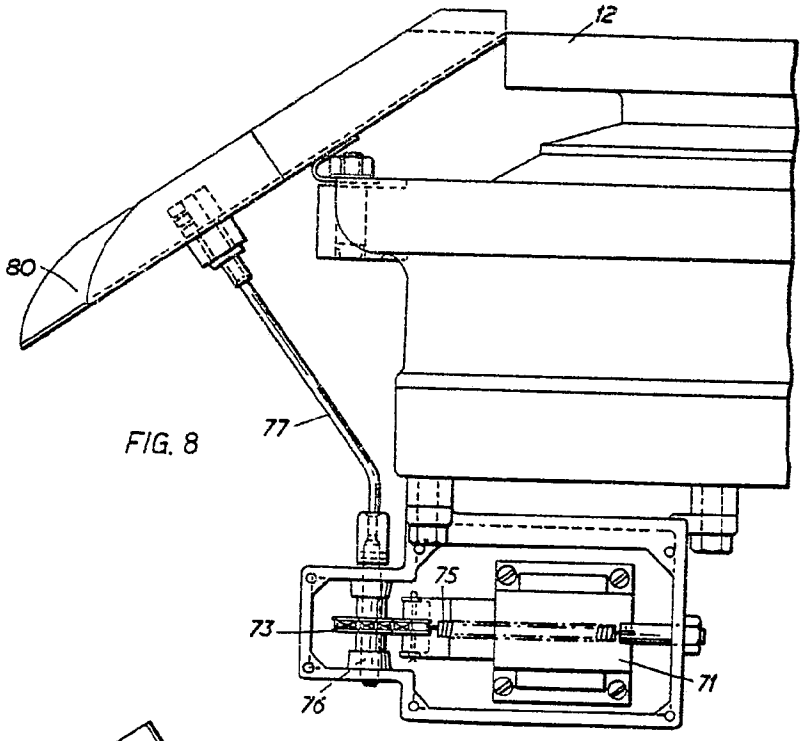

FIG. 8

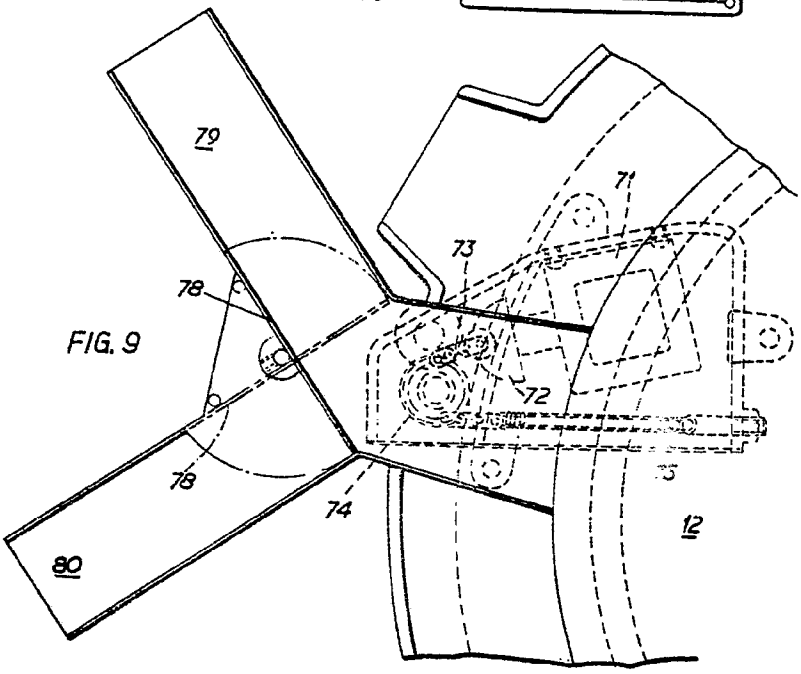

FIG. 9

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SHEETS 3 & 4

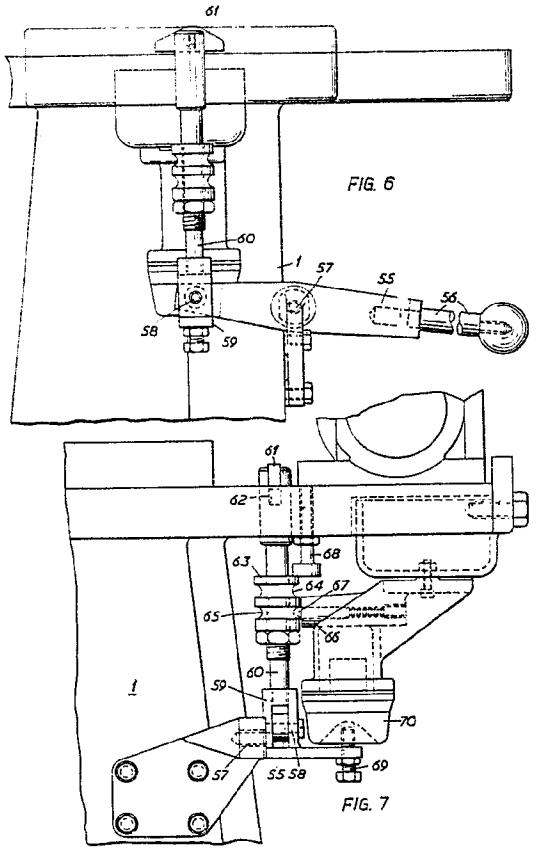

FIG. 6

FIG. 7

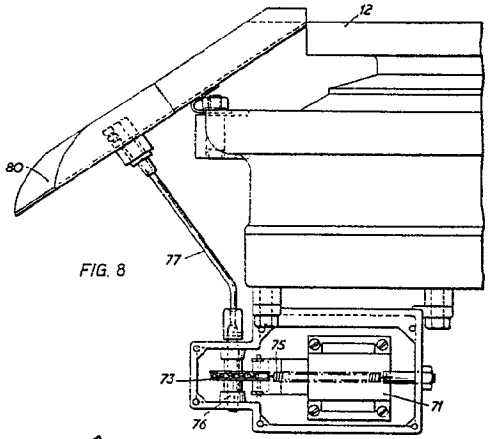

FIG. 8

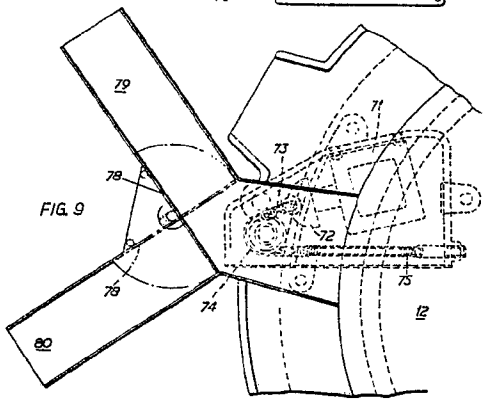

FIG. 9